Make Icewine Easier, at Least for Yeast

Extreme Winemaking

Story by Debra Inglis

Icewine is a unique beverage. Without a doubt, that 'uniqueness' comes at the price of pushing winemakers to their wits' end. In fact, some winemakers have termed the grueling process 'extreme winemaking.' From draping the crop in miles of awkward, expensive netting to thwart bird attacks, to picking in the middle of bone-chilling nights (including on holidays), to the irksome stickiness on everything it contacts in your winery, to repeatedly clogging costly filters, making icewine can be a ruthless pursuit. And don't think for a minute that the sticky stuff gives you a break when it comes to fermenting it. No chance. This is when it puts your yeast through the microbial equivalent of Marine Corps basic training.

It seems the very thing that makes icewine juice good for taste buds (i.e., its intense sweetness) is the very thing that makes it bad for yeast. Super-sweet icewine juice is hostile territory for yeast; stressful to the point of hindering their growth and metabolism. This, in turn, causes sluggish, incomplete fermentations, which can lead to wines with low alcohol and high volatile acidity (VA).

There's good news, however, for icewine producers. These problems can be combated with an arsenal of best practices.

Consider the following questions when trying to achieve optimal performance from your yeast in the boot camp we call icewine:

1) What is the starting sugar concentration of the juice?

2) How much yeast should be added?

3) How should the yeast be conditioned before being added to the super-sweet juice?

4) What micronutrients are needed to help the yeast ferment to completion?

At a Glance

- Super-sweet icewine juice is hostile territory for yeast, causing sluggish, incomplete fermentations, which can lead to wines with low alcohol and high volatile acidity (VA).
- These problems can be combated with an arsenal of best practices.
- Icewine juice should not exceed 42° Brix.
- Use more than twice as much yeast as used for table wines.
- Acclimatize the yeast to the super-sweet juice.
- Add micronutrients during yeast re-hydration.

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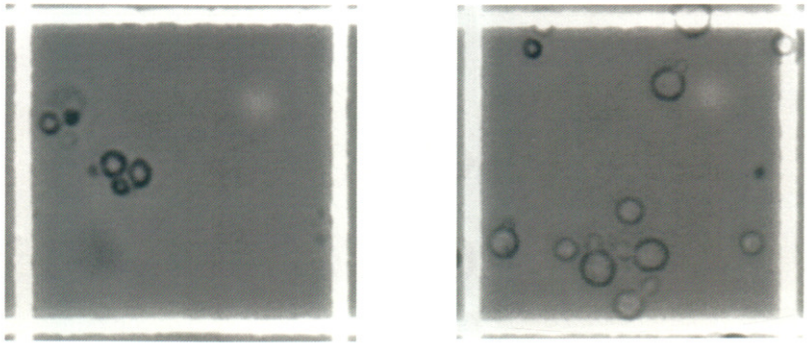


Osmotic stress reduces yeast cell size, limits cell growth and sugar consumption, and stimulates glycerol and acetic acid production.

I've drawn from research by our team at the Cool Climate Oenology and Viticulture Institute to answer the questions herein.

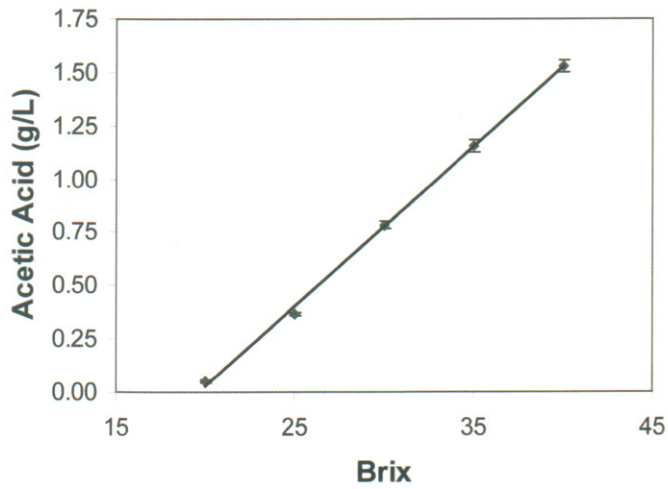
ICEWINE JUICE SHOULD NOT EXCEED 42° BRIX

In evaluating over three hundred icewine juice samples from the Niagara Region in southern Ontario, Canada, the sugar concentrations were found to range from 32 to 46° Brix. According to regulations set by the Vintners Quality Alliance (VQA) of Ontario, blended icewine juice that is to be used for icewine fermentation must be at a minimum of 35° Brix. When juice above 42° Brix is fermented, yeasts are hard pressed to achieve a target of 10% alcohol by volume (v/v)—the industry standard for icewine—before they stop fermenting.

There is a strong negative linear correlation between ethanol in the final wine and initial icewine juice concentration (i.e., the higher the starting Brix, the lower the alcohol in the finished wine). As an example, using riesling icewine juice at 46° Brix fermented over a one-month period, we found only 6.5% alcohol v/v was reached before the yeast stopped fermenting. We also found that, in excess of 52.5° Brix, icewine juice is theoretically non-fermentable by yeast (Pigeau et al, 2007).

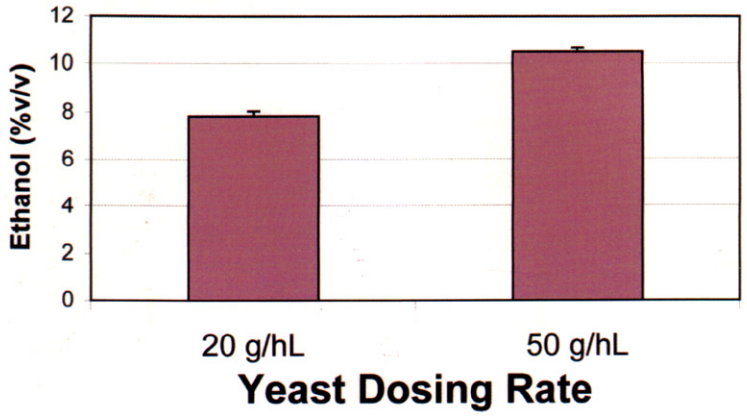
USE MORE THAN TWICE AS MUCH YEAST AS USED FOR TABLE WINES

Due to the stress imposed by concentrated icewine juice, yeasts multiply no more than two or three times when fermenting icewine. So, if an inadequate amount of yeast is used, the yeast population will not amass sufficiently to finish the fermentation in a practical time frame (i.e., four weeks). And the target alcohol concentration of 10 % v/v may not be reached.



Acetic acid production by wine yeast is a function of the initial juice concentration.

If you were to use the amount of yeast advised for table wine fermentations (i.e., 20 grams per hectoliter), you could expect an icewine with a final ethanol concentration of roughly 8% alcohol v/v. So it's best to add yeast at two and a half times the table wine rate (i.e., 50 g/hL) to allow the population to grow and ferment to a minimum of 10% alcohol v/v in a one-month time frame.



Ethanol production in icewine increases by using a higher yeast inoculation rate.

ACCLIMATIZE THE YEAST TO THE SUPER-SWEET JUICE

Our research team devised a three-hour yeast conditioning procedure that minimizes sugar shock for yeast in icewine juice, resulting in less VA production and faster, more complete fermentations (Kontkanen et al. 2004).

The procedure is as follows:

1. Re-hydrate the yeast in ten times their weight of warm water (40°C) for 15 minutes.

2. While the yeast are rehydrating, dilute a small amount of icewine juice in half to 20° Brix and allow it to come to room temperature (approximately 25° C).

3. After the yeast have re-hydrated in water for 15 minutes, add an equal volume of room temperature, diluted icewine juice to the re-hydrated yeast and maintain for one hour at 25 to 30° C, with gentle stirring every 30 minutes. (The yeast starter culture is now at approximately 10° Brix)

4. Add an equal volume of room temperature icewine juice to the starter culture, then maintain the culture for two hours at room temperature with gentle stirring every 30 minutes. (The yeast starter culture is now at approximately 20° Brix.)

5. Add the starter culture to the intended tank of icewine juice (Note: Ensure the tank juice is pre-warmed to 20° C) at the high dosing rate of 50 grams of yeast/hL.

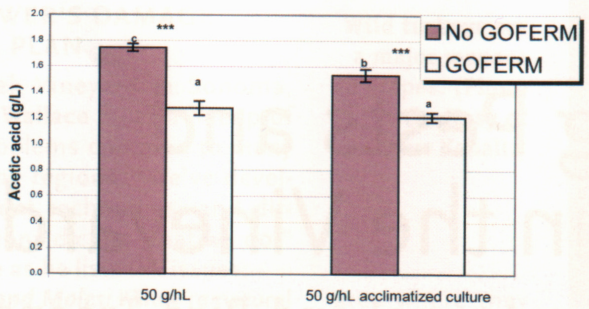
6. It is advised to let the yeast further acclimatize to the juice at 20°C for one day, allowing cell growth to start, before lowering the fermentation temperature to 17° C.

ADD MICRONUTRIENTS DURING YEAST REHYDRATION

By adding the yeast micronutrient preparation GOFERM from Lallemand, yeast cell growth is stimulated during icewine fermentation, resulting in shorter fermentations and less VA in finished wines. The combination of rehydrating yeast with GOFERM and acclimatizing the yeast to the icewine juice can result in 30% less VA in wines and reduce the fermentation time by one week to achieve 10% v/v alcohol.

SUMMARY

Aside from dealing with many of the nuisances that are part and parcel with making icewine, at least now you can make icewine easier on your yeast and optimize their performance when fermenting the super-sweet nectar. Remember: To achieve at least 10%



Lowering volatile acidity in icewine by rehydrating yeast in the presence of GOFERM Micronutrient and acclimatizing the yeast to Icewine juice prior to fermentation.

alcohol v/v in your icewine, don't let your juice exceed 42° Brix. Also, it's important to use two-and-a-half times the amount of yeast that you would normally add when making table wines.

That is, while 20 grams of yeast per hectoliter is sufficient for table wines, 50 grams of yeast per hectoliter is needed for icewine fermentations, especially in juices ranging from 40 to 42°Brix. And, before you add your yeast to the bulk of your icewine juice, be sure to pamper them with micronutrients (e.g., GOFERM) and give them gradual conditioning to the concentrated juice. This will minimize the time needed to achieve sufficient alcohol while lessening the tendency for the yeast to produce acetic acid.

Even so, it's important to keep in mind that the acid profile in icewine is greatly influenced by weaker yeast organic acids (e.g., acetic and succinic acids), which can increase a wine's titratable acidity (i.e., relative to the initial juice) but also elevate its pH. So it may be necessary to add acid for a more palatable sweet to sour balance in the finished wine.

As well as finding ideal conditions for icewine fermentations, our research team is working to better understand yeast metabolism as it relates to acetic acid production.

Over the past eight years, we have started to unravel the yeast metabolic pathway used to produce acetic acid during icewine fermentation and we have defined ways to reduce its production. We are also in the process of screening different yeast strains at the genetic level to identify which ones are best suited for icewine fermentations.

REFERENCES

Pigeau et al, 2007, J. Appl. Microb. 103:1691-1698

Kontkanen et al. 2004 Am.J. Enol. Vitic. 55: 363-370.